

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
9 December 2004 (09.12.2004)

PCT

(10) International Publication Number  
**WO 2004/106847 A1**

(51) International Patent Classification<sup>7</sup>: **G01B 7/06**,  
B23B 49/00

(21) International Application Number:  
PCT/SE2004/000837

(22) International Filing Date: 1 June 2004 (01.06.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/320,244 2 June 2003 (02.06.2003) US  
60/481,027 26 June 2003 (26.06.2003) US

(71) Applicant (for all designated States except US): **NOVA-TOR AB** [SE/SE]; Stormbyvägen 6, S-163 55 Spånga (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ODÉN, Erik** [SE/SE]; Sköldvägen 4, S-187 36 Täby (SE). **PETTERSSON, Björn** [SE/SE]; Morkullevägen 44, S-175 64 Järfälla (SE).

(74) Agent: **ALBIHNS STOCKHOLM AB**; Linnégatan 2, P.O. Box 5581, S-114 85 Stockholm (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

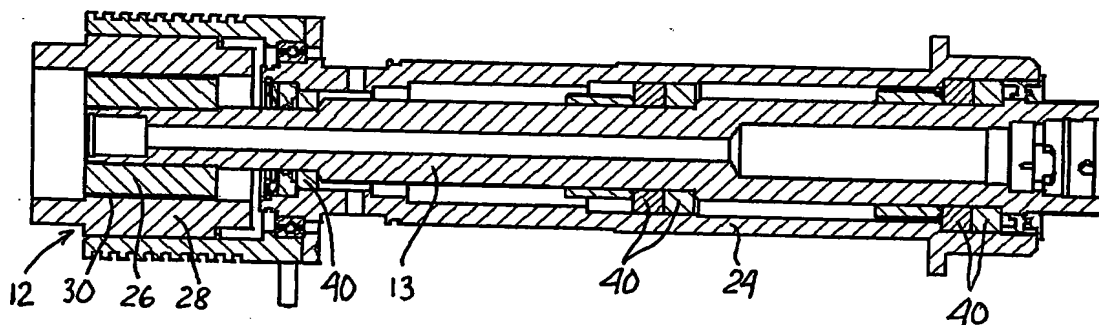
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND APPARATUS FOR MEASURING A DEPTH OF HOLES IN COMPOSITE-MATERIAL WORKPIECES BEING MACHINED BY AN ORBITING CUTTING TOOL



(57) Abstract: A method and apparatus for measuring the depth of a hole in a composite-material workpiece being machined by a rotating and orbiting cutting tool (14). The method includes the steps of applying a low-level electric potential to an electrically insulated cutting tool (14), the cutting tool having a cutting head (57) with radial and axial cutting edges (60, 58) and with a predetermined axial length (L), determining a first zero reference position of the cutting tool as it initially contacts a first surface of the workpiece and thereby closes an electric circuit through a grounded workpiece (W), and detecting a second reference position when the cutting head (57) of the cutting tool (14) penetrates an opposite, second surface of the workpiece. The reference positions are registered by a measuring means. The depth of the finished hole is determined by deducting the predetermined axial length (L) of the cutting head (57) having penetrated the workpiece from the total length of axial advancement of the cutting tool from the first zero reference position to the second reference position. The orbital machining apparatus includes ceramic bearings (40) electrically insulating the spindle (13) and the cutting tool (14) from surrounding components of the apparatus.